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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/512,378	02/25/2000	Oscar Chi-Lim Au	016660-038	7227

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EXAMINER
THOMPSON, JAMES A

ART UNIT	PAPER NUMBER
2624	4

DATE MAILED: 09/15/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/512,378	AU ET AL.	
	Examiner	Art Unit	
	James A Thompson	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____ .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-22 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-22 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 25 February 2000 is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Information Disclosure Statement

1. The listing of references in the specification is not a proper information disclosure statement. 37 CFR 1.98(b) requires a list of all patents, publications, or other information submitted for consideration by the Office, and MPEP § 609 A(1) states, "the list may not be incorporated into the specification but must be submitted in a separate paper." Therefore, unless the references have been cited by the examiner on form PTO-892, they have not been considered. The references contained on lines 19-32 of page 1 are not included in form PTO-1449 submitted by applicant. US Patent 5,243,444, which is mentioned on line 4 of page 2 of the application and on form PTO-1449, has been considered.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claims 1-22 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claims contain subject matter which was not described in the specification in such a way as to enable one skilled in the art to

which it pertains, or with which it is most nearly connected, to make and/or use the invention. Claims 1 and 22 specifically refer to "obtaining for each individual pixel a continuous value as a weighted sum." Claims 2-4, 6 and 13-17 specifically refer to a "significance coefficient." However, the algorithm(s) and program code(s) for calculating said weighted sum and said significance coefficient are not adequately described in the specification so that one skilled in the art can formulate and implement said algorithm(s) and program code(s). Furthermore, the best mode of implementing said algorithm(s) and program code(s) is not adequately specified.

Claim 3 states "said significance coefficient of each neighborhood pixel is an indication of the likelihood that the value of that neighborhood pixel in the original image is correlated with the value of the individual pixel in the original image." However, neither the claim nor the specification disclose how or in what manner the significance coefficient performs this function. This would not enable someone skilled in the art to implement this claim.

Claim 7 would require undo experimentation for someone skilled in the art to implement the claim. Claim 7 states "a method according to claim 6 in which f(v) is a non-linear function." "Non-linear function" is a very broad term that can potentially cover many functions and function types. It would therefore not be capable of implementation without extensive trial and error. Said non-linear function has not been adequately disclosed or stated in either the claim or the specification.

Claim 10 is not adequately disclosed, requiring undo experimentation for someone skilled in the art to implement the claim. Claim 10 states "a method according

to claim 8 in which f(v) is a function of the form $f(v)=a(1-v/b_1)\ (1-v/b_2)\ldots(1-v/b_k)$, where a is a predefined number, k is a predefined integer, $\{b_k\}$ are a set of k predetermined numbers." While the form of the equation for f(v) is given in the claim, no range of values for the constants or method of determining said values is disclosed either in the claim or in the specification. This would require the individual attempting to implement the claim to excessively experiment in order to determine what the proper values should be for the constants in said equation.

3. Claims 11 and 12 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claims contain subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. The specification fails to disclose any details pertaining to "forming an enhanced reconstructed image as a linear combination of said reconstructed image and a continuous image derived from said halftone image by a second image reconstruction method." The specification merely mentions this as one possible variation of the overall scheme proposed in the application. The specification does not adequately disclose the required steps necessary to form "the enhanced reconstructed image" or an algorithm or program code by which one skilled in the art could implement this claim. It would therefore require undo experimentation on the part of one attempting said implementation.

4. Claim 22 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. The "image enhancement apparatus" is not disclosed in the specification. No details of the construction, implementation or operation of said apparatus are disclosed by the applicant.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claims 2, 13 and 14 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite. Each of said claims states that "each of said pixels takes more than two values" which is confusing and indefinite in view of said claims and the specification. One possible interpretation is that each pixel is represented by one of more than two possible values. In this case, the current claim language is indefinite and must be amended for clarification. Another possible interpretation, to which said claims appear to conform, is that each pixel is represented by more than one value simultaneously. In this case, the claim language is non-enabling and is rejected under 35 U.S.C. 112, first paragraph.

Claim Interpretations

6. For the purpose of examining the claims over the prior art, the Examiner made the following interpretations:

-- In Claims 2 (lines 19-20 of page 18), 13 (lines 33-34 of page 19) and 14 (lines 17-18 of page 20), the phrase "each of said pixels takes more than two values" is interpreted to mean "each of said pixels takes one of more than two possible values."

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

7. Claims 1-8 and 12-22 are rejected under 35 U.S.C. 102(b) as being anticipated by Wong (US Patent 5,506,699). Claims 1 and 22 are anticipated by Wong since Wong teaches a method for converting halftone images into gray scale images. Said gray scale images are reconstructions from original images that were converted to halftone images. Said gray scale images are comprised of a plurality of pixels and have continuous values. Furthermore, a neighborhood for each individual pixel containing said pixel and a plurality of pixels that are proximate to said individual pixel is determined for each pixel for the purpose of calculating a weighted sum. The first

iteration must necessarily compute continuous values for each pixel from the binary values of said halftone image since those are the only values available from said halftone image. Further iterations use the continuous values calculated from the previous iteration (line 62 of column 6 to line 23 of column 7 of Wong).

Referring to lines 24-67 of column 5 of Wong, it can be seen that the variables $v_{m,n}$ used in the weighted sum perform the same essential function as the significance coefficients disclosed by the applicant. Said variables $v_{m,n}$ are used as the normalized weights in a weighted sum. Hence, it can be determined that the use of significance coefficients is effectively the same as the use of said values in Wong demonstrated in lines 38-43 of page 5 of Wong. Therefore, Wong also anticipates Claims 2 and 13. Additionally, the use of low-pass filtering is taught by Wong (lines 20-23 of column 5 of Wong), so Wong also anticipates Claim 14. Claims 16 and 17 are also anticipated by Wong since Wong further teaches that this algorithm can be performed not just on halftone images, but also on gray scale images (lines 38-42 of column 8 of Wong).

Wong further teaches the use of a sample mean about which the weighting values are calculated (lines 51-67 of column 5 of Wong). This performs the same essential function as the baseline value disclosed by the applicant since both values are based on a sample mean and both values are used to compare the pixel values against. Therefore, Claims 4, 5 and 15 are also rejected.

With regard to Claim 3, Wong further teaches a value "that characterizes locally the amount of variations among the pixels" within the neighborhood (lines 35-37 of column 3 of Wong). Said value is used in the calculation of a weighted sum. This is

functionally similar to "an indication of the likelihood that the value of that neighborhood pixel is in the original image is correlated with the value of the individual pixel in the original image" and said value is the same value discussed above ($v_{m,n}$) that performs the same essential function as the significance coefficients. Therefore, Claim 3 is also anticipated by Wong.

Wong further teaches a general apparatus for performing the functions of image input, image processing, and image output (line 58 of column 8 to line 17 of column 10 of Wong). One such apparatus which falls under the definition of said apparatus is "a computer program product which is readable by a computing device to cause the computing device to perform" the image processing method. Therefore, Wong also anticipates Claims 18-21.

With regard to Claim 6, Wong teaches a function that is decreasing and that operates upon the value of the absolute difference between the pixel value and the baseline value (lines 44-58 of column 7 of Wong).

Regarding Claim 7, Wong teaches the use of a non-linear function (lines 1-9 of column 6 of Wong).

With regard to Claim 8, Wong teaches the use of a continuous function (lines 51-67 of column 5 of Wong).

Claim 12 is rejected as being anticipated by Wong since Wong discloses that "low pass filtering is the conventional way of reconstructing gray scale images from binary images" (lines 34-35 of column 2 of Wong). Therefore, the claim that "said second image reconstruction method is a low pass filter" has been anticipated.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Jodoin, et al., US Patent 5,493,419 A, February 1996.

Zhigang Fan, US Patent 5,243,444 A, September 1993.

Ron J. Karidi, US Patent 6,222,641 B1, April 2001.

Ping W. Wong, European Patent 0 622 949 A1, February 1994.

Christopher M. Miceli and Kevin J. Parker, "Inverse Halftoning", Journal of Electronic Imaging, April 1992, volume 1, number 2, pages 143-151.

Nguyen T. Thao, "Set Theoretic Inverse Halftoning", Proceedings of IEEE Conference on Image Processing, October 1997, volume 1, pages 783-786.

Ping Wah Wong, "Inverse Halftoning and Kernel Estimation for Error Diffusion", IEEE Transactions on Image Processing, April 1995, volume 4, number 4, pages 486-498.

Li-Meng Chen and Hsueh-Ming Hang, "An Adaptive Inverse Halftoning Algorithm", IEEE Transactions on Image Processing, August 1997, volume 6, number 8, pages 1202-1209.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to James A Thompson whose telephone number is 703-

305-6329. The examiner can normally be reached Monday through Friday between the hours of 8:30AM and 5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David K Moore can be reached on 703-308-7452. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-305-3500.

James A. Thompson
Examiner
Art Unit 2624

JAT
September 8, 2003

DAVID MOORE
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